U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-258 294

Johnson Reservoir, Dawson and Gosper Counties, Nebraska

Corvallis Environmental Research Lab, Oreg

Prepared for

Nebraska State Dept of Environmental Control, Lincoln

Aug 76

288070

PB 258 294

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

REPORT

ON

JOHNSON RESERVOIR

DAWSON AND GOSPER COUNTIES

NEBRASKA

EPA REGION VII

WORKING PAPER No. 558

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

☆G.P.O. 699-440

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.
3. RECIPIENT'S ACCESSION NO.	
4. TITLE AND SUBTITLE Report on Johnson Reservoir, Dawson and Gosper Counties, Nebraska	5. REPORT DATE Prepared August 1976 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Anonymous (National Eutrophication Survey Staff)	8. PERFORMING ORGANIZATION REPORT NO Working Paper # 558
9. PERFORMING ORGANIZATION NAME AND ADDRESS National Eutrophication Survey U.S. Environmental Protection Agency 200 S. W. 35th St. Corvallis, Oregon 97330	10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Office of Research and Development U.S. Environmental Protection Agency 401 M Street, S. W. Washington, DC 20460	13. TYPE OF REPORT AND PERIOD COVERED Final - 1974 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES
Prepared in cooperation with the U.S. Environmental Protection Agency, National Environmental Research Center, Las Vegas, Nevada 89114

16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 05C

PRICES SUBJECT TO CHANGE

18. DISTRIBUTION STATEMENT Release unlimited	19. SECURITY CLASS (This Report)	21. NO. OF PAGES 33
	20. SECURITY CLASS (This page)	22. PRICE $4.00

EPA Form 2220-1 (9-73)

REPORT
ON
JOHNSON RESERVOIR
DAWSON AND GOSPER COUNTIES
NEBRASKA
EPA REGION VII
WORKING PAPER No. 558

WITH THE COOPERATION OF THE
NEBRASKA DEPARTMENT OF ENVIRONMENTAL CONTROL
AND THE
NEBRASKA NATIONAL GUARD
AUGUST, 1976

CONTENTS

	Page
Foreword	ii
List of Nebraska Study Reservoirs	iv
Lake and Drainage Area Map	v
Sections	
I. Conclusions	1
II. Lake and Drainage Basin Characteristics	3
III. Lake Water Quality Summary	4
IV. Nutrient Loadings	8
V. Literature Reviewed	12
VI. Appendices	13

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Nebraska Department of Environmental Control for professional involvement, to the Nebraska National Guard for conducting the tributary sampling phase of the Survey, and to those wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

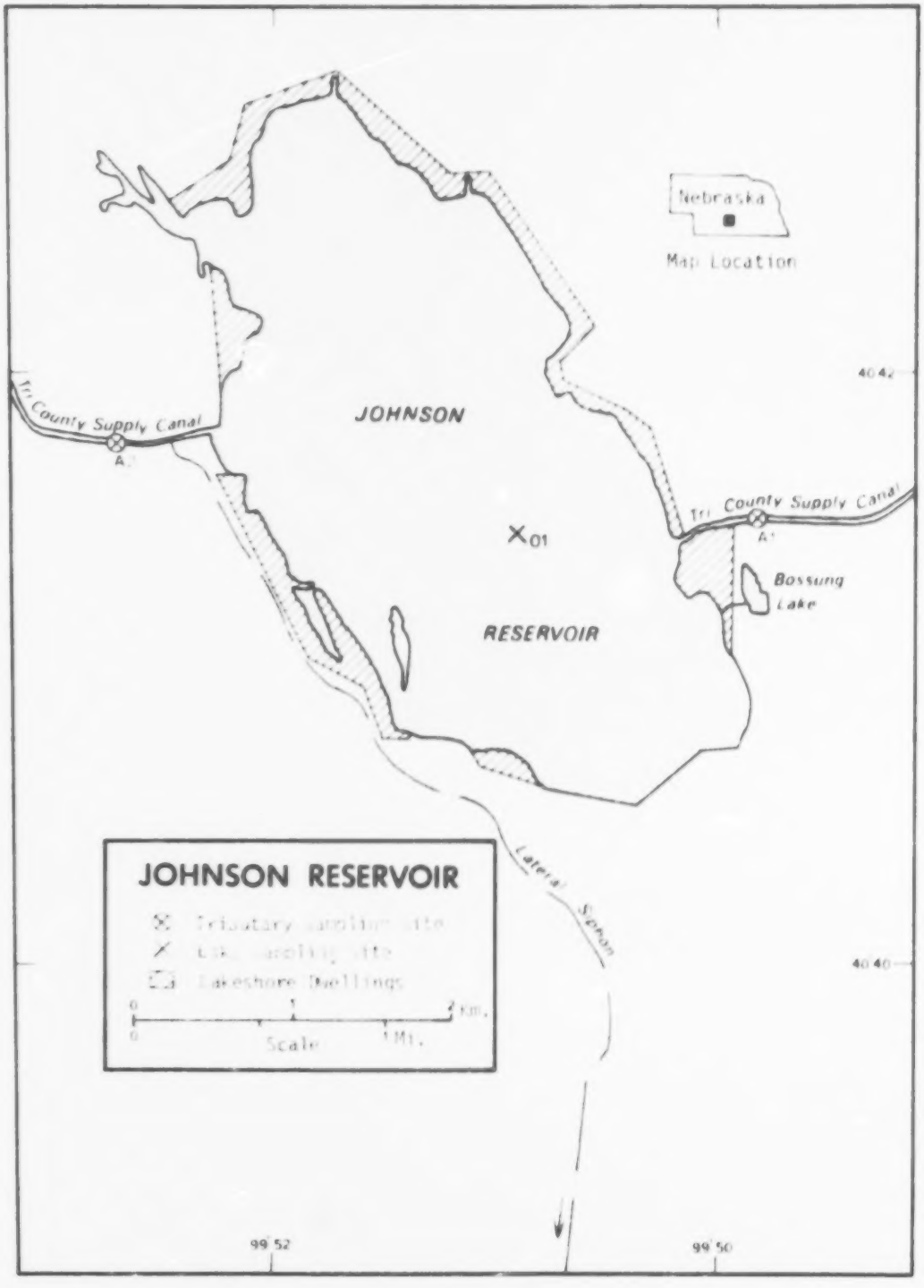
The staff of the Water Pollution Control Division, Department of Environmental Control, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

Major General Francis L. Winner, the Adjutant General of Nebraska, and Project Officer Colonel Burl M. Johnson, who directed the volunteer efforts of the Nebraska National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STATE OF NEBRASKA

RESERVOIR NAME	COUNTY
Branched Oak	Lancaster
Harlan County	Harlan
Harry D. Strunk	Frontier
Hugh Butler	Frontier, Red Willow
Johnson	Dawson, Gosper
McConaughy	Keith
Pawnee	Lancaster
Sherman	Sherman
Swanson	Hitchcock


Nebraska
Map Location
JOHNSON
RESERVOIR
Tri County Supply Canal
Tri County Supply Canal
Bassung Lake
X01
Lateral Station
JOHNSON RESERVOIR
Tributary sampling site
Lake sampling site
Lakeshore Dwellings
0 1 2 km.
0 Scale 1 Mi.
40 42
40 40
99 52
99 50

JOHNSON RESERVOIR

STORET NO. 3105

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate Johnson Reservoir is eutrophic. It ranked eighth in overall trophic quality wnen the nine Nebraska water bodies sampled in 1974 were compared using a combination of six parameters*. Seven of the water bodies had less median total phosphorus, one had less median dissolved phosphorus, five had less median inorganic nitrogen, seven had less mean chlorophyll a, and all of the other water bodies had greater mean Secchi disc transparency.

B. Rate-Limiting Nutrient:

The algal assay results show that Johnson Reservoir was phosphorus limited at the times the samples were collected (March and September, 1974). The reservoir data also indicate phosphorus limitation.

C. Nutrient Controllability:

1. Point sources--No known municipal point sources impacted Johnson Reservoir during the sampling year; however, septic tanks serving shoreline dwellings were estimated to have contributed 0.2% of the total phosphorus load to the reservoir.

* See Appendix A.

The present phosphorus loading of 6.72 $g/m^2/yr$ is nearly four times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 11).

2. Non-point sources--The Tri County Supply Canal contributed an estimated 99.5% of the total phosphorus loading to Johnson Reservoir during the sampling year.

The drainage area (watershed) of Johnson Reservoir is shown as 0.0 km^2 because it is an off-channel pumped-storage reservoir used primarily for power production, irrigation, and recreation. Irrigation return flows probably would be high in nutrients, and any significant reduction of the phosphorus input to Johnson Lake would involve removal of phosphorus in these flows.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Lake Morphometry††:

1. Surface area: 11.53 kilometers^2.
2. Mean depth: 6.1 meters.
3. Maximum depth: 18.0 meters.
4. Volume: 70.333 x 10^6 m^3.
5. Mean hydraulic retention time: 27 days (based on outflow).

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Tri County Supply Canal	0.0	33.37
Minor tributaries & immediate drainage -	0.0	0.0
Totals	0.0	33.37

2. Outlet -

Tri County Supply Canal	0.0	29.65

C. Precipitation***:

1. Year of sampling: 52.3 centimeters.
2. Mean annual: 54.4 centimeters.

---

† Table of metric conversions--Appendix B.
†† Hartung, 1974; Adamovich, 1975.
* Pumped storage (Robertson, 1976).
** Includes area of reservoir.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Johnson Reservoir was sampled three times during the open-water season of 1974 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at one station on the reservoir (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was collected for phytoplankton identification and enumeration; and a similar sample was collected for chlorophyll a analysis. During the March and September visits, a single 18.9-liter depth-integrated sample was taken for algal assays. The maximum depth sampled was 9.1 meters.

The sampling results are presented in full in Appendix D and are summarized in the following table (the July nutrient samples were not properly preserved and were not analyzed).

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR JOHNSON RESERVOIR
STORET CODE 3105

PARAMETER	1ST SAMPLING (4/16/74) 1 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/ 1/74) 1 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (9/30/74) 1 SITES RANGE	MEAN	MEDIAN
TEMP (C)	7.8 - 8.5	8.2	8.3	21.9 - 22.1	22.0	22.0	14.7 - 14.7	14.7	14.7
DISS OXY (MG/L)	10.6 - 11.4	11.1	11.4	6.4 - 8.8	7.2	6.8	8.4 - 8.8	8.6	8.7
CNDCTVY (MCROMO)	719. - 729.	725.	727.	897. - 903.	900.	900.	629. - 722.	653.	630.
PH (STAND UNITS)	8.4 - 8.5	8.5	8.5	8.2 - 8.4	8.3	8.4	8.5 - 8.6	8.5	8.5
TOT ALK (MG/L)	173. - 176.	175.	175.	****** -**********			178. - 179.	179.	179.
TOT P (MG/L)	0.100 - 0.111	0.106	0.106	****** -**********			0.044 - 0.051	0.048	0.049
ORTHO P (MG/L)	0.009 - 0.010	0.009	0.009	****** -**********			0.008 - 0.014	0.010	0.008
NO2+NO3 (MG/L)	0.500 - 0.520	0.510	0.510	****** -**********			0.060 - 0.070	0.065	0.065
AMMONIA (MG/L)	0.030 - 0.040	0.035	0.035	****** -**********			0.070 - 0.080	0.075	0.075
KJEL N (MG/L)	0.700 - 1.100	0.850	0.800	****** -**********			0.500 - 0.600	0.575	0.600
INORG N (MG/L)	0.530 - 0.550	0.545	0.550	****** -**********			0.130 - 0.150	0.140	0.140
TOTAL N (MG/L)	1.210 - 1.610	1.360	1.310	****** -**********			0.560 - 0.670	0.640	0.665
CHLRPYL A (UG/L)	42.8 - 42.8	42.8	42.8	9.8 - 9.8	9.8	9.8	25.8 - 25.8	25.8	25.8
SECCHI (METERS)	0.5 - 0.5	0.5	0.5	0.6 - 0.6	0.6	0.6	0.6 - 0.6	0.6	0.6

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
04/16/74	1. Stephanodiscus sp.	23,760
	2. Asterionella sp.	921
	3. Diatoma sp.	614
	4. Chlamydomonas sp.	537
	5. Surirella sp.	499
	Other genera	2,112
	Total	28,443
07/01/74	1. Fragilaria sp.	2,346
	2. Stephanodiscus sp.	739
	3. Melosira sp.	304
	4. Aphanizomenon sp.	261
	5. Synedra sp.	217
	Other genera	651
	Total	4,518
09/30/74	1. Melosira sp.	2,232
	2. Stephanodiscus sp.	536
	3. Aphanizomenon sp.	476
	4. Oscillatoria sp.	357
	5. Anabaena sp.	208
	Other genera	1,160
	Total	4,969

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (ug/l)
04/16/74	1	42.8
07/01/74	1	9.8
09/30/74	1	25.8

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. April sample -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.035	0.533	8.6
0.005 P	0.085	0.533	11.7
0.050 P + 1.0 N	0.085	1.533	13.5
1.0 N	0.035	1.533	7.6

b. September sample -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.005	0.122	0.2
0.050 P	0.055	0.122	4.3
0.050 P + 1.0 N	0.055	1.122	9.6
1.0 N	0.005	1.122	0.2

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Johnson Lake was high at the time the first assay sample was collected (04/16/74) but was moderate at the time the second sample was taken (09/30/74).

The algal assay results also show that Johnson Lake was phosphorus limited at both sampling times. The addition of orthophosphorus alone or in combination with nitrogen resulted in significantly increased yields while the addition of nitrogen alone did not.

The mean inorganic nitrogen/orthophosphorus ratios also are indicative of phosphorus limitation; i.e., the N/P ratios were 60/1 in April and 14/1 in September.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Nebraska National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the months of June and August when two samples were collected. Sampling was begun in August, 1974, and was completed in August, 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Nebraska District Office of the U.S. Geological Survey for the tributary sites nearest the reservoir.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*.

* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal -

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Johnson Lake	?	stab. pond	?	no discharge*

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/yr	% of total
a. Tributaries (non-point load) -		
Tri County Supply Canal	77,095	99.5
b. Minor tributaries & immediate drainage (non-point load) - None		-
c. Known municipal STP's - None	-	-
d. Septic tanks** -	165	0.2
e. Known industrial - None	-	-
f. Direct precipitation*** -	200	0.3
Total	77,460	100.0

2. Outputs -

Lake outlet - Tri County Supply Canal 52,295

3. Net annual P accumulation - 25,165 kg.

* Robertson, 1976.
** Estimate based on 574 shoreline dwellings; see Working Paper No. 175.
*** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Tri County Supply Canal	1,604,345	98.8
b. Minor tributaries & immediate drainage (non-point load) - None		-
c. Known municipal STP's - None	-	-
d. Septic tanks* -	6,115	0.4
e. Known industrial - None	-	-
f. Direct precipitation** -	12,450	0.8
Total	1,622,910	100.0

2. Outputs -

Lake outlet - Tri County Supply Canal	1,172,080

3. Net annual N accumulation - 450,830 kg.

* Estimate based on 574 shoreline dwellings; see Working Paper No. 175.
** See Working Paper No. 175.

D. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	6.72	2.18	140.8	39.1

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of lake

"Dangerous" (eutrophic loading)

"Permissible" (oligotrophic loading)

V. LITERATURE REVIEWED

Adamovich, Ted, 1975. Personal communication (reservoir morphometry). NE Dept. of Env. Contr., Lincoln.

Hartung, Ray, 1974. Personal communication (reservoir morphometry). NE Dept. of Env. Contr., Lincoln.

Robertson, James, 1976. Personal communication (waste treatment facilities around Johnson Lake; flow and drainage area). Central NE Pub. Power and Irr. Dist., Holdrege.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
3101	BRANCHED OAK	0.044	0.070	456.444	17.033	9.400	0.011
3102	HARLAN COUNTY RESERVOIR	0.112	0.365	476.111	27.822	12.200	0.061
3103	HARRY D. STRUNK (MEDICIN	0.064	0.460	470.500	14.367	14.200	0.004
3104	HUGH BUTLER (RED WILLOW)	0.061	0.040	488.875	16.612	14.400	0.014
3105	JOHNSON RESERVOIR	0.075	0.340	477.667	26.133	8.600	0.004
3106	LAKE MCCONAUGHY	0.027	0.585	409.555	8.644	11.400	0.004
3107	PAWNEE LAKE	0.060	0.175	453.000	15.367	8.800	0.020
3108	SHERMAN COUNTY RESERVOIR	0.067	0.090	451.167	6.717	11.800	0.050
3110	SWANSON RESERVOIR	0.067	0.090	466.333	14.450	11.000	0.016

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
3101	BRANCHED OAK	88 (7)	100 (8)	63 (5)	25 (2)	75 (6)	63 (5)	414
3102	HARLAN COUNTY RESERVOIR	0 (0)	25 (2)	13 (1)	0 (0)	25 (2)	0 (0)	63
3103	HARRY D. STRUNK (MEDICIN	50 (4)	13 (1)	25 (2)	75 (6)	13 (1)	81 (6)	257
3104	HUGH BUTLER (RED WILLOW)	63 (5)	75 (5)	38 (3)	38 (3)	0 (0)	50 (4)	264
3105	JOHNSON RESERVOIR	13 (1)	38 (3)	0 (0)	13 (1)	100 (8)	81 (6)	245
3106	LAKE MCCONAUGHY	100 (8)	0 (0)	100 (8)	88 (7)	50 (4)	100 (8)	438
3107	PAWNEE LAKE	75 (6)	50 (4)	75 (6)	50 (4)	88 (7)	25 (2)	363
3108	SHERMAN COUNTY RESERVOIR	38 (3)	75 (5)	88 (7)	100 (8)	38 (3)	13 (1)	352
3110	SWANSON RESERVOIR	25 (2)	75 (5)	50 (4)	63 (5)	63 (5)	38 (3)	314

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	3106	LAKE MCCONAUGHY	438
2	3101	BRANCHED OAK	414
3	3107	PAWNEE LAKE	363
4	3104	SHERMAN COUNTY RESERVOIR	352
5	3110	SWANSON RESERVOIR	314
6	3104	HUGH BUTLER (RED WILLOW)	264
7	3103	HARRY D. STRUNK (MEDICIN	257
8	3105	JOHNSON RESERVOIR	245
9	3102	HARLAN COUNTY RESERVOIR	83

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NEBRASKA 12/23/75

LAKE CODE 3105 JOHNSON LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 0.0

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3105A1	0.0	28.74	32.42	34.40	32.28	29.48	28.01	29.48	28.57	24.83	28.26	29.48	29.96	29.65
3105A2	0.0	28.63	32.76	34.43	34.49	35.00	34.32	35.88	38.60	32.68	31.06	31.06	31.40	33.37
3105ZZ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 0.0
SUM OF SUB-DRAINAGE AREAS = 0.0

TOTAL FLOW IN = 756.23
TOTAL FLOW OUT = 756.23

NOTE *** NO DRAINAGE AREAS. OFF CHANNEL STORAGE. (PUMPED)

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3105A1	8	74	26.53	25	24.10				
	9	74	21.44						
	10	74	24.39	6	25.40				
	11	74	19.45	11	20.93	16	19.20		
	12	74	26.04	8	23.28				
	1	75	25.77	5	22.12				
	2	75	28.52	9	25.85				
	3	75	30.27	25	26.70				
	4	75	29.56						
	5	75	23.56	18	30.92				
	6	75	34.89	1	29.08	24	48.56		
	7	75	54.93	6	35.71				
	8	75	30.38	4	39.67	24	27.16		
	9	75	27.27	29	22.71				
3105A2	8	74	37.43	25	29.31				
	9	74	38.10						
	10	74	23.98	6	23.28				
	11	74	26.42	11	26.67	16	26.08		
	12	74	28.94	8	26.90				
	1	75	29.17	5	26.56				
	2	75	29.90	9	26.56				
	3	75	31.66	25	27.38				
	4	75	30.72						
	5	75	30.36	18	32.76				
	6	75	43.89	1	35.68	24	42.62		
	7	75	45.76	6	40.10				
	8	75	39.64	4	47.23	24	36.90		
	9	75	33.13	29	28.32				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/12/23

310501
40 41 00.0 099 55 00.0
JOHNSON RESERVOIR
38009 NEBRASKA

11EPALES
3

2111202
0036 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/04/16	15 20	0000	8.5		18	729	8.55	176	0.040	1.100	0.510	0.010
	15 20	0005	8.5	11.4		728	8.50	175	0.030	0.800	0.520	0.009
	15 20	0015	8.2	11.4		725	8.45	174	0.030	0.800	0.500	0.009
	15 20	0030	7.8	10.6		719	8.40	173	0.040	0.700	0.510	0.010
74/07/01	09 25	0000	22.1	8.8	25	903	8.20					
	09 25	0005	22.0	6.8		902	8.40					
	09 25	0015	22.0	6.8		900	8.40					
	09 25	0025	22.0	7.0		900	8.30					
	09 25	0030	21.9	6.4		897	8.40					
74/09/30	09 35	0000	14.7	8.4	24	629	8.50	178	0.070	0.600	0.070	0.014
	09 35	0005	14.7	8.8		722	8.50	178	0.070	0.500	0.060	0.009
	09 35	0015	14.7	8.6		629	8.60	179	0.080	0.600	0.070	0.008
	09 35	0025	14.7	8.8		630	8.50	179	0.080	0.600	0.060	0.008

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/04/16	15 20	0000	0.104	42.8	
	15 20	0005	0.100		
	15 20	0015	0.108		
	15 20	0030	0.113		
74/07/01	09 25	0000		9.8	
	09 25	0002			1.0
74/09/30	09 35	0000	0.051	25.8	
	09 35	0005	0.044		
	09 35	0015	0.049		
	09 35	0025	0.050		

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 76/01/27

3105A1
40 41 30.0 099 49 48.0
TRICOUNTY SUPPLY CANAL
31 7.5 JOHNSON LAKE
O/JOHNSON LAKE
SEC RD BRDG .9 M N OF JCT US HWY 283
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/08/25	09 00		0.056	0.600	0.060	0.015	0.040
74/10/06	15 40		0.060	0.800	0.045	0.010	0.050
74/11/11	16 40		0.089	0.700	0.035	0.010	0.060
74/11/16	10 15		0.090	0.950	0.050	0.005	0.040
74/12/08	18 00		0.184	1.000	0.035	0.010	0.030
75/01/05	18 30		0.352	1.600	0.072	0.020	0.050
75/03/25	17 30		0.655	1.900	0.042	0.082	0.130
75/05/18	21 00		0.010	0.350	0.030	0.025	0.030
75/06/01	19 30		0.015	1.050	0.318	0.015	0.040
75/06/24	18 30		0.090	0.800	0.185	0.037	0.080
75/07/06	15 00		0.230	0.900	0.080	0.020	0.065
75/08/04	21 00		0.055	2.100	0.100	0.010	0.040
75/08/24	19 00		0.085	1.500	0.057	0.010	0.080

STORET RETRIEVAL DATE 76/01/27

3105A2
40 41 45.0 099 52 42.0
TRICOUNTY SUPPLY CANAL
31 7.5 ELWOOD
T/JOHNSON LAKE
SEC RD BRDG 3.6 M NW OF JCT US HWY 283
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/08/25	09 30		0.156	0.800	0.030	0.015	0.057
74/10/06	16 00		0.100	1.000	0.025	0.040	0.055
74/11/11	17 00		0.136	0.500	0.025	0.010	0.040
74/11/16	10 35		0.144	1.000	0.035	0.005	0.050
74/12/04	17 30		0.312	1.000	0.092	0.015	0.050
75/01/05	17 45		0.600	2.100	0.456	0.040	0.050
75/03/25	17 30		0.534	2.500	0.040	0.082	0.110
75/05/18	20 30		0.005	1.150	0.020	0.050	0.070
75/06/01	18 30		0.005	1.450	0.220	0.010	0.050
75/06/24	17 30		0.315	2.400	0.270	0.055	0.140
75/07/06	14 00		0.045	0.800	0.130	0.030	0.080
75/08/04	20 00		0.210	1.300	0.057	0.015	0.080
75/08/24	18 00		0.160	1.150	0.040	0.010	0.100